



**THE EFFECTS OF SUPPLY CHAIN  
ORIENTATION, SUPPLY CHAIN  
MANAGEMENT, AND COLLABORATION  
ON PERCEIVED FIRM PERFORMANCE**

GRADUATE RESEARCH PROJECT

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AFIT/ILS/ENS/12-06

**DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY**

**AIR FORCE INSTITUTE OF TECHNOLOGY**

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PERFORMANCE

GRADUATE RESEARCH PROJECT

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Logistics Management

Jodi M. Tinney, BS, MBA

June 2012

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Abstract

The relationship between supply chain orientation (SCO), supply chain management (SCM), collaboration, and the effects of those concepts on firm performance are of interest to numerous firms and organizations who have adopted a supply chain management paradigm in managing their operations. As established in previous research however there is a distinction between SCO and SCM. SCO is the manifestation of the supply chain mindset within the firm, while SCM is the propagation of the supply chain mindset across firms. As has been established in the literature numerous times, there is a presumed link between SCO and/or SCM, and organizational performance. One presumed link between SCO and SCM and performance is collaboration. The knowledge-based view holds that firm-specific knowledge “bundles” help firms create difficult to replicate capabilities, thereby creating a competitive advantage in the marketplace. One commonly held view is that collaboration helps create these firm-specific knowledge bundles.

This research project looks at the constructs of SCO, SCM, and collaboration on perceived firm performance. The researcher offers significant statistical results on the investigation of the relationships between these constructs. The results of the study discussed here suggest that a relationship does exist between SCO and collaboration and the effects on perceived firm performance.

### **Acknowledgements**

I would like to express my sincere appreciation to my faculty advisor, Dr. William Cunningham for his support, guidance and patience throughout the course of this thesis effort. I would also like to thank Lt. Col. Joseph Skipper who believed in me enough to not take “no” for an answer when I insisted that I did not want to start a Masters degree. Without the support and motivation provided by Dr. Cunningham and Lt. Col. Joseph Skipper, I would not have accepted this remarkable opportunity to further my education and career.

I would also like to thank my family and friends for supporting me through this process. I would like to especially express my gratitude to those who continually listened to my banter about course work and research even when they had no idea what I was talking about.

Jodi M. Tinney

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# THE EFFECTS OF SUPPLY CHAIN ORIENTATION, SUPPLY CHAIN MANAGEMENT, AND COLLABORATION ON PERCEIVED FIRM PERFORMAMNCE

## I. Introduction

### **Background**

As the nature of business evolves, firms seek new practices to improve their business processes in an attempt to better fulfill the promises made to their customers. Supply chain management is a concept that many leading edge firms have been practicing and perfecting over the past few decades. Competition is tighter than ever as globalization provides more options for partnerships within a supply chain, as well as economic conditions and changes in technology applications. Additionally, as globalization creates new opportunities for channel partnerships, it also provides customers with new options when purchasing products and services. Firms who wish to maintain their success continue to seek new and unique methods to improve the relationships with their supply chain partners and ultimately create a competitive advantage for their own firm as well as the supply chain as a whole.

The relationship between supply chain orientation (SCO), supply chain management (SCM), and collaboration is a topic that is of interest to many firms who have adopted a supply chain management model within their operations. As discussed in

Min et al. (2007), a firm must possess a supply chain orientation if they want to maintain a positive relationship with their supply chain partners. Min et al. (2007) defines supply chain orientation as the processes utilized “within a firm” and supply chain management as the processes utilized “across firms within a supply chain.” A firm’s SCO is developed based on the culture of the organization. Trust, commitment, the sharing of common relationship-building foundations, compatibility between organizations and the support of executive-level management contribute to a firm’s SCO. These are customs that have been instilled within the organization and have become engrained in normal operating procedures. SCM is defined as a management philosophy that requires a systematic approach to viewing the supply chain as a whole versus a divided set of entities. Mentzer et al. (2001) describes the SCM philosophy as a “synchronization of intra-firm and inter-firm operational and strategic capabilities into a unified, compelling marketplace force.” As firms begin establishing cross-functional strategies within their organizations and as they become better aligned with their supply chain partners, the implementation of the philosophy of SCM occurs and the philosophy evolves into a set of tactical operations that can be used to operationalize processes and procedures.

While many firms focus on practices to improve their business processes internally, the external processes are often overlooked. However, previous research (Cooper et al., 1997; Stank et al., 2001) concludes that the benefits of supply chain management will not be realized if external processes are not examined just as thoroughly as internal processes. A comprehensive review of the literature provides an abundant amount of research describing the presumed link between SCO, SCM and the effect of these constructs on firm performance. It is possible that effectiveness of SCM

within a firm is not due solely to SCO; however, SCO may be the foundation on which SCM is built and becomes effective. Conversely, it is essential for a firm to maintain external relationships with other firms included within a supply chain through SCM. Without these external relationships, SCO alone is unlikely to create the benefits sought in a systematic approach. Therefore, according to the literature, firms must possess both SCO and SCM to be successful.

One possible link between SCO, SCM, and firm performance is collaboration. However, this link has not been widely researched. According to previous research by Wernerfelt (1984), there is a belief that firm-specific knowledge “bundles” assist firms in creating capabilities that are difficult to replicate, often times creating a competitive advantage for the firm. As maintained by Frohlich and Westbrook (2001), collaboration is integral when creating these firm-specific “bundles” of knowledge. Collaboration includes the integration of processes both inside the firm as well as across all other organization within the supply chain. Internal collaboration is defined by Schrage (1990) as “an affective, mutually shared process where two or more departments work together, have mutual understanding, have a common vision, share resources, and achieve collective goals.” Departments within an organization must function with an understanding of the availability of resources to be shared in an effort to achieve the goals and objectives established by the firm. Without this understanding, a duplication of efforts may occur and valuable resources wasted (Stank et al., 2001). According to Tjosvold (1998), collaboration between departments promotes greater employee satisfaction as well as improved productivity and morale. The positive working

environment created by collaborative practices utilized between departments can increase the overall performance of the firm (Kahn and Mentzer, 1998).

Not only must collaboration occur between the departments in an organization, but it should also occur among firms linked within a supply chain. Andraski (1998) indicates that increased collaboration between supply chain partners will result in lower total delivered costs and enhance the overall service performance of the supply chain. Collaboration can be achieved between supply chain partners by engaging in joint planning efforts, sharing of risks and rewards, developing an atmosphere of trust, exchanging of information, and establishing parallel corporate cultures (Gardner et al., 1994; Cooper et al., 1997). Similarly, internal collaboration can be achieved through cross-functional planning, coordination, and the sharing of integrated databases (Sanders and Premus, 2005).

Firms should pay careful consideration to the partnerships developed within a supply chain. Not all members of a supply chain will require the strength of partnership relationships, nor should all members have access to the information exchanged between partners. Ultimately, firms who aspire to better firm performance should practice collaboration both internally and externally between strategic members of the supply chain who have similar SCO's, SCM philosophies, and collaborative structures in place.

### **Problem Statement**

The major issue addressed in this research project is whether SCO, SCM, and collaboration have an effect on firm performance.

Therefore the hypothesis investigated within this research project is:

*H<sub>1</sub>: Supply chain orientation, supply chain management, and collaboration are all positively related to firm performance.*

*H<sub>0</sub>: There is no relationship between supply chain orientation, supply chain management, collaboration, and firm performance.*

Firm performance in this research project is operationalized in terms of the profitability of the organization as well as the potential growth of sales and will be measured based upon the respondent's own opinion on how their firm is performing relative to the goals that are established by executive-level management of the firm. This research project examines the notion that a firm's performance is improved when firms have an embedded SCO which provides a foundation for the implementation of SCM philosophies and collaborative practices both internally between departments and externally between supply chain members.

## **Methodology**

This research will utilize a survey instrument to address the research question. Responses to questions contained within the survey will be analyzed to determine if SCO, SCM, and collaboration do in fact have an effect on firm performance. Factor analysis will be conducted to ensure that the items contained within the survey instrument do measure the constructs of SCO, SCM, collaboration, and firm performance. Next, Linear Regression analysis will be used to analyze whether the variables either demonstrates a relationship or refutes a relationship between the variables.

## **Scope and Limitations**

While it would be interesting to also include technology use and supply chain performance as two constructs within this research project, it was not feasible to do so. A number of research studies have concluded that the use of technology assisting in the

development supply chain functions has been a source for the improvement of firm performance. Additionally, a firm's technological maturity has also been discussed as a prerequisite to a firm's successful operations. It would have been insightful to survey firms on how they use technology with their supply partners and whether the use and maturity of technology assists a firm in better collaborating with their supply chain partners. Furthermore, it would have been appealing to analyze the effect of SCO, SCM, and collaboration on a firm's supply chain performance as well as firm performance based upon financial and marketing benchmarks. Supply chain performance has been measured in previous research with scale items addressing supply chain cost improvements, efficiency of new product introductions, and quality improvement initiatives. However, due to the large number of survey items originally used to test the SCO, SCM, collaboration, and firm performance constructs, ancillary constructs had to be eliminated in an effort to maximize response rates.

### **Summary/Preview**

This chapter discussed the background of the research contained within this research project as well as presented the research question and briefly examined the methodology of the research. Chapter 2 provides a general overview of the literature pertaining to SCO, SCM, and collaboration. Chapter 3 details the methodology approach, introduces the development of the research model and addresses the challenges associated with the research. Chapter 4 documents the results derived from the survey instrument and attempts to link the constructs to performance of the responding firm. Finally, Chapter 5 provides conclusions and presents topics for future research.



## **II. Literature Review**

Efficiency and effectiveness are two areas where firms continually strive to improve. Effectiveness refers to the ability to meet goals created by the organization while efficiency refers to the resources that are needed to achieve those goals. In an effort to improve upon these two fields, managers have begun undertaking efforts to review and improve upon processes both internally and externally. Much of this process improvement has entailed promoting collaboration between departments within a firm as well as between firms contained within a supply chain. However, prior to the initiation of collaborative processes, a firm must possess a SCO and a SCM philosophy firmly planted within the organization (Min et al., 2001). Min et al. (2001) defines SCO as “the recognition by an organization of the systematic, strategic implications of the tactical activities involved in managing the various flows in a supply chain.” Therefore, firms who possess SCO must first have a clear understanding that initiatives launched by the firm must comply with collaborative processes both internally as well as extend those collaborative processes over the supply chain (Mentzer et al., 2001). According to Mentzer et al. (2000), it is imperative for a firm to perform internal collaboration in order to manage processes within a supply chain if the firm is seeking improved firm performance. A brief literature review is conducted to discover and discuss the previous research associated with the constructs investigated in this graduate research project.

## **Supply Chain Orientation**

According to Mentzer et al. (2001), SCO directly influences firm performance through the development and sustainment of “behavior elements” that allow a firm to build relationships with their supply chain partners. As described by Min et al. (2007), SCO is a necessary factor in creating value within an organization by providing a profit to the firm while maintaining a desired level of customer service. These SCO elements that are necessary to initiated a SCM philosophy are: credibility, benevolence, commitment, cooperative norms, organizational compatibility, and top management support. The research for each of these topics is reviewed and discussed.

### *Credibility*

One of the behavioral elements that Mentzer et al. (2001) discuss is credibility. Siguaw et al. (1998) describes credibility as “the belief that a trading partner is an expert and reliable in conducting transactions effectively.” A firm must be a credible and trusted partner to the members within their supply chain. In order for firms to truly trust their supply chain partners, that partner must demonstrate an expertise within their field and be a reliable source of knowledge to their upstream and downstream partners (Ganesan, 1994). A firm can acquire the element of credibility by earning a reputation of “fairness” as discussed by Ganesan (1994). The reputation of fairness is gained by a firm when they engage in reliable and consistent behavior over a period of time. Ganesan (1994) found that firms who are trusted and viewed as credible by their supply chain partners tend to maintain long-term relationships with these partners.

### *Benevolence*

The second behavior element discussed by Mentzer et al. (2001) is benevolence. Benevolence is described in a number of research studies as the belief that a firm's supply chain partners are involved in and responsible for the actions necessary to create a successfully-run organization (Deutsch, 1958; Larzelere and Huston, 1980; Rempel et al., 1985). A supply chain partner's willingness to accept the possibility of short-run risks is another aspect of a firm's belief of a supply chain partner's benevolence (Anderson and Weitz, 1992). Lastly, according to Anderson and Narus (1990), a supply chain partner "will not take unexpected actions that would have a negative impact on the firm." Benevolence can also be attained by grading the past performance of a supply chain partner. According to Ganesan (1994), a firm's satisfaction with past outcomes is positively related to the perception of a supply chain partner's benevolence. The means by which a supply chain partner earns benevolence is a factor in earning the trust of the firm with whom they are working (Lindskold, 1978). Ultimately, the trust achieved between two organizations will produce a positive working relationship between both the firm and the supply chain partner as well as generate profitable results for both organizations.

### *Commitment*

Commitment is the third behavior element detailed by Mentzer et al. (2001). Porter et al. (1974) describes commitment as "a multi-dimensional construct reflected by the belief in and acceptance of the organization's goals and values, a willingness to exert effort on behalf of the organization, and a strong desire to maintain membership in an organization." Another definition of commitment provided by Anderson and Weitz

(1992) is the engagement between a firm and its supply chain partners in “a desire to develop a stable relationship, a willingness to make short-term sacrifices to maintain the relationship, and a confidence in the stability of the relationship.” The element of commitment has been proven to be an important component in the development of trusting and long-term partnerships (Lambert et al., 1999). Before a partnership can be developed, a firm and its supply chain partners must demonstrate behavior that encourages a partnership through a “continual relationship” (Dwyer et al., 1987). In this initial stage of relationship building, the supply chain partner performs in a manner that is both beneficial for both the firm and for themselves. The satisfaction provided by this relationship to the firm creates a situation where the firm would not receive additional benefits by switching supply chain partners (Dwyer et al., 1987). Similarly, Morgan and Hunt (1994) describe a four-step process in achieving commitment between supply chain partners: “Commitment occurs when (1) providing resources, opportunities, and benefits that are superior to the offerings of alternative partners, (2) maintaining high standards of corporate values and allying oneself with exchange partners having similar values, (3) communicating valuable information, including expectations, market intelligence, and evaluations of the partner’s performance, and (4) avoiding malevolently taking advantage of exchange partners.” These activities described in previous studies are crucial when forming a commitment with supply chain partners.

### *Cooperative Norms*

Cannon and Perreault (1999) describe cooperative norms as “the reflection of expectations between two parties when working together to achieve mutual and individual goals jointly.” The concept of cooperative norms is another behavioral

element discussed by Mentzer et al. (2001) when analyzing a firm's SCO. These expected patterns of behavior provide a framework for procedural guidelines for how the organizations will work together toward a common goal in the future (Dwyer et al., 1987). Cooperative norms are integral in creating working procedures for how organizations will manage problems as well as how they will share rewards. Establishing these cooperative norms relieves the potential for risk when building a relationship between supply chain partners.

#### *Organizational Compatibility*

Bucklin and Sengupta (1993) define organizational compatibility as “complementary goals and objectives, as well as similarity in operating philosophies and corporate cultures.” Furthermore, Mentzer et al. (2001) describe organizational compatibility as an element that becomes engrained within an organization in order for that firm to possess a SCO. Similarly, Anderson and Weitz (1992) describe organizational compatibility as two firms possessing goal compatibility and a trusting relationship with one another. In order for firms to be compatible organizationally, they must operate with similar operating principles, employ a similar cultural environment, and utilize comparable management techniques. It has been noted in previous studies that if firms within a supply chain are organizationally compatible, the probability is high that SCM processes will assist in the improvement of the entire supply chain's effectiveness and efficiency (Ellram and Cooper, 1990; Cooper et al., 1997; Lambert et al., 1998).

### *Top Management Support*

Support by executive-level managers is the last element discussed by Mentzer et al. (2001) that must be inherent in firms that possess an SCO. According to Bowersox et al. (2003), it is necessary for firms to obtain top management support to “create and formalize” collaborative processes between supply chain partners. Without the support of these executive-level managers, it is possible that the buy-in needed by a firm’s employees to support changes in procedures or processes may not occur. Previous research has indicated that top management support, leadership, and the commitment to change by top management are all antecedents to SCM, indicating that these characteristics must exist within a firm’s culture (SCO) in order for SCM to materialize (Lambert et al., 1998).

### **Supply Chain Management**

The term “supply chain management” has assumed many definitions over the past few decades. According to Min et al. (2007), SCM is a method to improve efficiency (cost reduction) and effectiveness (customer service) to create a competitive advantage that will result in benefits for the entire supply chain. Simply described by Lambert et al. (1998), SCM is the “alignment of firms that brings products or services to the market.” The alignment of firms enables independent organizations such as the “raw material and component producers, product assemblers, wholesalers, retailer merchants, and transportation companies” to move the materials forward to manufacture a product (La Londe and Powers, 1993; Simatupang and Sridharan, 2002). Lastly, Mentzer et al. (2001) describes SCM as “a set of three or more entities (organizations or individuals)

directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer.” There are a number of additional definitions in existence of SCM in the literature as displayed in Figure 1.

**Figure 1: Supply Chain Management Definitions**

DEFINITIONS OF SUPPLY CHAIN MANAGEMENT	
Monczka, Trent, and Handfield (1998)	SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire materials process, and also requires joint relationships with suppliers across multiple tiers. SCM is a concept, “whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers.”
La Londe and Masters (1994)	Supply chain strategy includes: “... two or more firms in a supply chain entering into a long-term agreement; ... the development of trust and commitment to the relationship; ... the integration of logistics activities involving the sharing of demand and sales data; ... the potential for a shift in the locus of control of the logistics process.”
Stevens (1989)	“The objective of managing the supply chain is to synchronize the requirements of the customer with the flow of materials from suppliers in order to effect a balance between what are often seen as conflicting goals of high customer service, low inventory management, and low unit cost.”
Houlihan (1988)	Differences between supply chain management and classical materials and manufacturing control: “1) The supply chain is viewed as a single process. Responsibility for the various segments in the chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution, and sales. 2) Supply chain management calls for, and in the end depends on, strategic decision making. “Supply” is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. 3) Supply chain management calls for a different perspective on inventories which are used as a balancing mechanism of last, not first, resort. 4) A new approach to systems is required—integration rather than interfacing.”
Jones and Riley (1985)	“Supply chain management deals with the total flow of materials from suppliers through end users...”
Cooper et al. (1997)	Supply chain management is “... an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user.”

(Mentzer et al., 2001)

SCM is concerned with the processes associated with the raw materials producer all the way to the end user of the product or service. These processes undergo rigorous

continual improvement evaluations to determine how these improvements might assist supply chain partners in the reduction of costs while maintaining a desired level of customer service (Jones and Riley, 1985; Stevens, 1989). Ultimately, the purpose of SCM is to enhance the value of the product or service to gain advantage over competitors (Stank et al., 2001). Numerous studies have confirmed a linkage between supply chain management and firm performance (Narasimhan and Jayaram 1998; Christopher, 1998; Wisner, 2003). Therefore, firms that wish to improve financial performance should examine its SCM practices to discover areas where process improvements can be made.

SCM is a combination of philosophy and tactical operations. A firm must understand the philosophy to actively implement activities that will create a well-functioning supply chain. Mentzer et al. (2001) describe the supply chain philosophy as “(1) a systems approach to view the supply chain as a whole rather than a set of fragmented parts, (2) a synchronization of intra-firm and inter-firm operational and strategic capabilities into a unified, compelling marketplace force, and (3) a focus on supply chain partners creating customer value.” Once a firm is cognizant of the philosophy, which is an element within a firm’s SCO, it is prepared to implement the activities that create dynamic relationships among firms, allowing them to work together towards a mutual goal while sharing the risks and rewards associated with the relationship between the supply chain members (Ellram and Cooper, 1990).

A common misconception noted in the literature is that all relationships within a supply chain must be partnerships. Stank et al. (2001) discuss that the philosophy of SCM is moving more towards partnerships than arm’s length relationships between firms within a supply chain. However, not all relationships within the supply chain should



result in a partnership. Partnerships can be costly and time consuming to maintain.

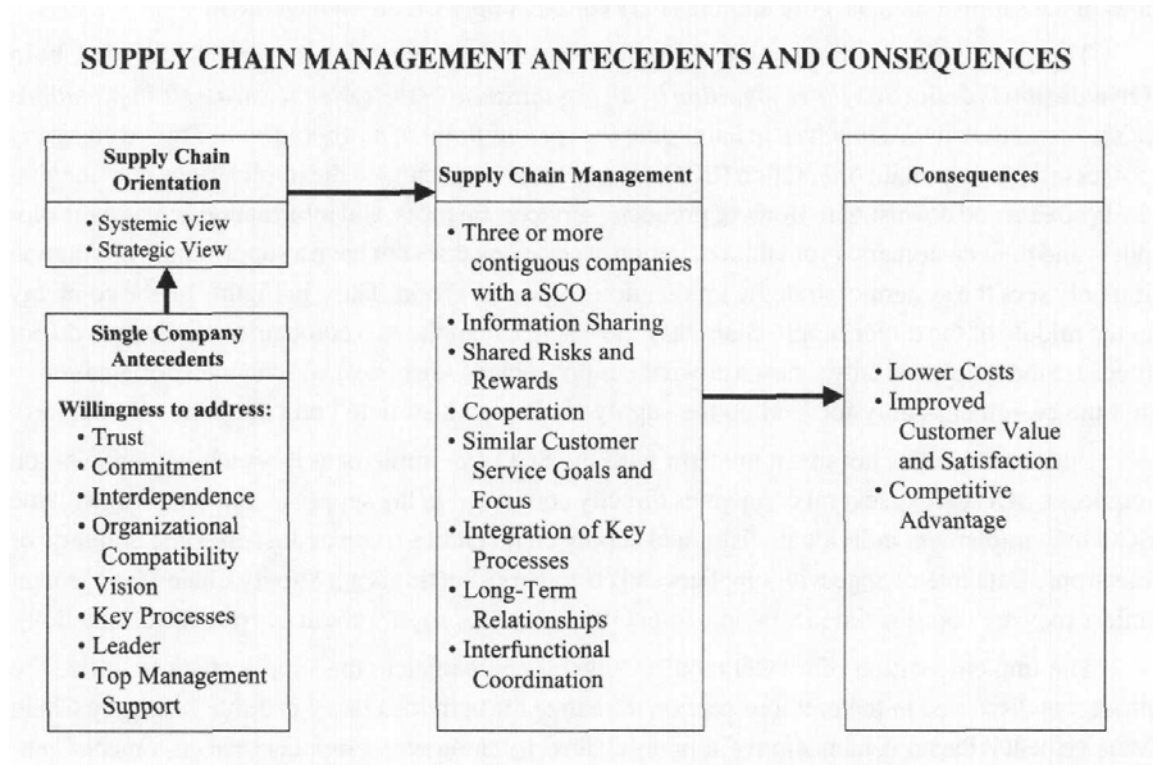
Cooper et al. (1997) discuss partnerships in previous research stating that “ a firm must assess which relationships are key and need closer ties and which can be managed from another perspective or not managed except through the allocation of purchase dollars.” However, even those relationships that do not result in a partnership must be carefully coordinated and a positive working relationship must be maintained.

SCM is also described in the literature as both functional and organizational. Cooper et al. (1997) indicates that functional SCM “refers to those traditional business functions that are included or excluded in the implementation and the process of supply chain management.” Conversely, organizational SCM is concerned with the types and kinds of internal relationships that will be useful to supply chain partners in the implementation of SCM (Cooper et al., 1997). It was noted in previous research that these organizational relationships both internally and externally bind supply chain partners together by allowing for greater success in the supply chain. As discussed previously by Mentzer et al. (2001), in order for this successful implementation to occur, both firms must possess an SCO.

Cooper et al. (1997) describe the processes associated with SCM as “collective efforts” for managing a supply chain. Six elements have been established as prerequisites for the construction of a successful supply chain: an agreement of the vision and focus of serving customers (Lambert et al., 1998), sharing of information between supply chain partners (e.g., Global Logistics Research Team at Michigan State University, 1995), sharing of risks and rewards (Cooper et al., 1997), cooperation in the form of performing coordinated activities throughout the supply chain (Anderson and Narus, 1990), building

and maintaining long-term relationships with supply chain partners (Mentzer et al., 2001), and agreement on the leadership within a supply chain (Min et al., 2007). Figure 2 details supply chain management antecedents and consequences as they relate to the components of supply chain management.

**Figure 2: Supply Chain Management Antecedents and Consequences**



(Mentzer et al., 2001)

### *Agreement of Vision and Goals*

When multiple firms work together within a supply chain, it is imperative for those firms to come to an agreement on the vision they have for the relationships formed and the goals they will accomplish by forming these relationships (Lambert et al., 1998). As Ross (1998) describes, vision and goal agreement “provide firms with specific goals and strategies on how they plan to identify and capitalize and realize the opportunities

they expect to find in the marketplace.” Without this agreement of vision and goals, it is likely that sub-optimization of supply chain processes would occur. The goal of SCM is for firms to be managed as a complete system; therefore an initial phase in SCM involves creating a vision for all members of the supply chain and set goals against that vision in an effort to create a strong and profitable supply chain with a competitive advantage against competitors.

### *Information Sharing*

There has been a great deal of previous research presented on information sharing. Information sharing is described by Cooper et al. (1997) as “frequent information updating among the chain members for effective supply chain management.” The sharing of information with supply chain partners is critical to the success of the supply chain. In previous research, Bowersox et al. (2003) discussed the critical nature of information sharing due to the necessity of providing the firm’s data to their supply chain partners in order for “operational connectivity” of an activity to occur. Strategic firm partners must provide each other with a landscape of data such as inventory levels, forecasts, sales promotion strategies, production runs, and marketing plans in order to reduce uncertainty between each other and to properly plan for their own business needs. Additionally, Sanders and Premus (2005) discuss the improvements in visibility between firms, production planning, inventory management, and distribution due to the sharing of information between firms. Anderson and Weitz (1992) affirm in their own research that the sharing of information results in increased commitment between supply chain partners. Information sharing also contributes to improvements in product quality as well as creating easier transitions when engaging in new product development projects

(Cannon and Perreault, 1999). Firms who do not engage in the transfer of information prohibit the efficiencies obtained through the successful implementation of SCM practices. Lee et al. (1997) cite “excessive inventory investment, poor customer service, lost revenues, misguided capacity plans, ineffective transportation, and missed production schedules” as the consequences of not readily sharing information with supply chain partners.

### *Risk and Reward Sharing*

Lambert et al. (1999) describes the sharing of risk as “the willingness of either party to take a short-term ‘hit’ for the good of the other.” Firms who are willing to accept this risk are compensated in the sharing of the rewards that are earned because of the efficiencies gained by the relationship. A number of studies have been conducted exploring the benefits of sharing risk and reward between supply chain partners involved in long-term relationships (Ellram and Cooper, 1990; Novack et al., 1995; Cooper et al., 1997). These studies document that firms involved in longer term relationships are more willing to share risk and reward and that by doing so, they gain a competitive advantage (Cooper and Ellram, 1993). In order for risk and reward to be shared amongst supply chain members, strategies for how this will be accomplished must be formed. Forming these strategies require a firm to create cooperative norms with procedures set firmly in place. A firm must possess an SCO to build and endorse these procedures within their own firm.

### *Cooperation*

Cooperation is yet another necessary element for maintaining an effective and efficient supply chain (Anderson and Narus, 1990; Ellram and Cooper, 1990). Anderson

and Narus (1990) describe cooperation as “complementary, coordinated activities performed by firms in a business relationship to produce superior mutual outcomes or singular outcomes that are mutually expected over time.” Cooperation is beneficial to an organization when collaborating on an activity with a partner bears additional advantages that could not be realized singularly (Porter, 1980). Previous studies have detailed how the process of cooperation develops. Cooperation begins with jointly planning activities. Once the planning has occurred, execution of the activities documented in the plan take place. The process ends with the evaluation of these activities so that the benefit of the partnership is realized (Ellram and Cooper, 1990; Novack et al., 1995; Cooper et al., 1997). However, cooperation is not easily ascertained. According to Morgan and Hunt (1995), cooperation can only be established when firms trust their supply chain partners and are committed to the partnership. Firms with an SCO are more likely to support business-related actions that promote the benefits of trusting and committed relationships. When cooperation is achieved within a supply chain, benefits such as reduced system-wide inventories and supply chain cost efficiencies can be obtained (Cooper et al., 1997).

### *Relationship Building*

Min et al. (2007) describe relationship building as an essential practice in firms who adopt SCM. Relationship building entails forming a connection with other firms within a supply chain in an attempt to build a relationship/partnership, if it is beneficial to do so. Golicic et al. (2003) describe the extent of costs associated with different types of relationships from arm’s length to joint ventures. In this research they discuss that few firms establish true partnerships due to the expense of forming that partnership. Forming less strategic relationships at a lower cost can be just as practical as building a partnership

as long as it is best for that firm's "portfolio of inter-organizational relationships" (Golicic et al., 2003). The foundation of relationship building is the amount of time and resources in which a firm is willing to invest. Golicic et al. (2003) also point to expense as well as time and resources as conditions for the type of relationship or partnership investigated. Therefore, a firm must acknowledge the amount of time, money, and resources they are willing to expend based upon the anticipated return on investment involved in maintaining that relationship.

#### *Agreement on Leadership*

In order for the supply chain to perform properly to gain a competitive advantage and ultimately reduce costs while maintaining a desired level of customer service, firms within a supply chain must come to an agreement on the installation of a leader to manage the strategy surrounding the supply chain. In previous research Bowersox et al. (2003) discuss the leadership process within in the supply chain, "the leadership process must provide the vision and willingness to enable the supply chain partners to creatively shift, share, and reward risk and responsibility." At the onset of new relationships it is inevitable that a degree of conflict will occur. The role of the supply chain leadership team is to engage in processes that will hold conflict to a minimum and produce a commitment by all firms to promote the wellbeing of the supply chain. Commitment allows the supply chain as a whole to overcome barriers to collaboration that may have been introduced in the initial phase of relationship building.

## **Collaboration**

Based on the research presented by Min et al. (2007), firms who have SCO embedded in their corporate culture are more likely to engage in SCM. According to Sanders (2007), in order for SCM to be successful, “integration, collaboration, and coordination across firm functions and throughout the supply chain” must exist. Therefore, in order for firms to create an efficient and effective supply chain, it is necessary to engage in internal and external collaboration. Stevens (1989) describes four stages of supply chain integration beginning at partial internal integration and ending with full external integration. In the first stage, all firms within a supply chain are operating independently of one another. Not only are they operating independently from other firms located in the supply chain, they are also functioning with fragmented internal processes. Stage two describes a development of internal focus on integration where firms attempt to reduce costs by improving upon internal processes. A transition to technology which allows firms to seamlessly transfer data from department to department and firm to firm is established in stage three. This implementation of technology will allow for the sharing of information with supply chain partners necessary to initiate stage four. Stage four completes the system-wide integration by including all members of the supply chain, both customer and supplier, in the sharing of information that allows for collection decision-making to occur. This four stage process depicts the necessity of internal collaboration establishment prior to external collaboration. Firms must initiate the process of working together within their own firm so that the benefits of external collaboration can be gained due to the experience acquired through the practice of

integrating internal functional processes. Chen et al. (2009) examine the effects of both internal and external integration and connects these activities to firm performance.

### *Internal Integration*

Kahn and Mentzer (1998) describe internal collaboration as a “process where departments work together with mutual understanding, common vision, and shared resources to achieve collective goals.” The goal of interdepartmental integration is the successful collaboration between departments such as Research and Development and Marketing, Manufacturing and Purchasing, Marketing and Manufacturing, and Human Resource Management and Manufacturing, to name a few. Previous research by Vickery et al. (1999) uncovered that internal collaboration is driven by SCM. Therefore firms who practice SCM also have departments participating in cross-functional exercises. According to Sanders and Premus (2005), “internal collaboration helps members of the organization access information in a timely manner, process relevant information efficiently, and make informed decisions both internally and across enterprises.” Not only does collaboration result in a positive impact on firm performance (Sanders and Premus, 2005), but it also promotes the awarding of contracts, greater employee satisfaction, improved productivity and morale, and an increase in employee confidence (Tjosvold, 1998).

### *External Integration*

External collaboration is described by Anderson and Narus (1990) as “the cooperation among independent but related firms to share resources and capabilities to meet their customers’ most extraordinary needs.” Bowersox et al. (2003) describe external collaboration in slightly different terms: collaboration occurs when two or more



firms willingly agree to integrate human, financial or technical resources to create a more efficient and effective supply chain. External collaboration leads to a more integrated operational approach. This integrated approach creates partnership elements between supply chain partners such as joint planning, sharing of risks and rewards, a willingness to engage in trusting relationships, information sharing, an agreement on operating controls across the supply chain, and cultural compatibility between firms (Gardner et al., 1994; Cooper et al., 1997). Previous studies have indicated that successful collaboration, both internal and external, can lead to reduced costs within a supply chain due to the elimination of duplicated activities that would have otherwise created a waste of resources (Andraski, 1998; Stank et al., 2001). Not only do firms collaborate with their suppliers, but they can also collaborate with their customers. According to Stank et al. (2001), “collaboration helps firms tailor service offerings to the specific requirements of customers of choice by identifying their long-term requirements, expectations, and preferences.” If firms are truly collaborative, they share the information that they receive from customers with their strategic suppliers in an effort to ensure that the requirements of the customer are fulfilled. A number of previous studies have confirmed a link between external collaboration and the performance of a firm. Stank et al. (2001) confirmed a positive link between collaboration and performance. Additionally, previous research indicates that internal collaboration is positively linked to external collaboration between a firm and its supply chain partners, which in turn enhances the performance of that firm (Monczka et al., 1998; Vickery et al., 1999; Sanders and Premus, 2005).

### **III. Methodology**

A survey was conducted to validate the hypothesis that there is a link between SCO, SCM, collaboration and perceived firm performance. A set of reliable and valid scale items to represent these constructs were extracted from previous research and combined to test the hypothesis.

#### **Data Collection**

Respondents were asked to evaluate statements within a questionnaire based on a seven-point Likert-type scale. Potential respondents were first contacted with a pre-survey email discussing the intent of the survey and information on the delivery date of the email invitation link to the respondent's email inbox. One week later, respondents were issued a survey invitation link via email which provided them with an online forum to record their responses to the survey items. The survey was sent to a total of 1,087 potential respondents. Initially, 159 respondents were eliminated from the sample due to inoperable email addresses. A total of 45 surveys were collected during a one-month period in which the survey was open for the collection of responses. Of the responses received, three survey responses were eliminated due to: (1) missing data, or (2) consistency motif occurred when the respondent firewalled the data by choosing one anchor that was used throughout the survey. Therefore, a total of 42 survey responses were usable, resulting in a 5 percent response rate.

#### *Demographics of Sample*

The sampling frame utilized for this survey consisted of executive-level logistics and supply chain management professionals employed by U.S.-based organizations

included in The Intermodal Association of North America (IANA) membership directory. The majority of the sample has been at their current position within their company between 0-10 years (60 percent). Additionally, 21 percent of respondents have been in their current position for 11-15 years. Lastly, 19 percent of respondents have been in their current position for 16-25 years. Therefore, the sample exhibits a great deal of experience within their current job role. Respondents were also asked to provide data on the length of employment with their current company. The largest category of response was 21-25 years (32 percent). Twenty-four percent of respondents have been with their current company for 11-15 years, followed by 22 percent at 6-10 years, 15 percent at 0-5 years, and lastly, 7 percent at 16-20 years. One last question asked respondents to discuss the amount of their total career experience in the supply chain industry. The majority of respondents (51 percent) have 21-25 years of supply chain experience, followed by 17 percent with 16-20 years, 15 percent with 6-10 years, 12 percent with 11-15 years and 5 percent with 0-5 years supply chain experience.

Respondents were also asked to classify the type of firm in which they are employed. A majority of individuals who responded to the survey classify their firms as service providers (e.g., 3PL, transportation, warehousing, or other services) (71 percent) while a small percentage of the total sample classify their firms as other (12 percent), manufacturers (10 percent), retailer (5 percent), and wholesaler/distributor (2 percent).

Additionally, respondents were also asked to provide information on the size of the firm in which they work. The majority of the individuals who responded classify their firms as small in size. Forty percent of respondents are employed at firms with less than 100 people, followed by 24 percent with 101-500 employees, 21 percent with more

than 5,001 employees, 12 percent with 1,001-5,000 employees and lastly, 2 percent with 501-1,000 employees.

Respondents were also asked to report the sales volume within their firms. Forty percent of respondents assert the sales volume of their firms is between \$1 million and \$50 million, while 26 percent of firms claim a sales volume of greater than \$501 million, followed by 17 percent between \$101 million-\$500 million, 14 percent between \$51 million-\$100 million, and lastly 2 percent with a sales volume of less than \$1 million.

### **Measurement Items Development**

Pre-tested scales derived from the literature were selected to measure SCO, SCM, collaboration and firm performance. A series of items were chosen to measure credibility, benevolence, commitment, cooperative norms, organizational compatibility, and top management support under the SCO construct. The items for credibility and commitment were adapted from Siguaw et al. (1998), benevolence from Kumar et al. (1995), cooperative norms from Cannon and Perreault (1999), organizational compatibility from Bucklin and Sengupta (1993), and top management support from Jaworski and Kohli (1993). Additionally, a series of items measuring agreement of vision and goals, information sharing, risk and reward sharing, cooperation, relationship building, and agreement on leadership were chosen to represent the SCM construct. Each of the items measuring the SCM construct was created in a previous study by Min et al. (2007). Lastly, items were chosen to measure both internal and external integration under the collaboration construct. This scale includes concepts measuring internal process integration, internal process simplification, external process integration, and

external process simplification, and was developed by Chen et al. (2009). The items measuring firm performance were adapted from a previous study by Chen et al. (2007). These items measuring both financial and marketing performance were modified from the original research to reflect performance relative to established company goals versus the previous research study where performance was measured in comparison to that firm's competitor's performance.

### **Analysis Procedures**

In order to determine whether the scales were measuring the appropriate construct, Confirmatory Factor Analysis (CFA) was conducted. Through the use of CFA, the researcher expects that the scale items will be consistent with the results of each of the previous studies where the constructs originated. CFA was used in an effort to assist in the empirical determination of the number of factors that underlie the construct of firm performance. The primary objective of factor analysis is to condense scale items into a smaller set of variables (factors) in an effort to explain the variation among the larger set of scale items using the smaller set of factors. CFA also assisted in defining the meaning of the factors which allows for analysis of the variation among the larger set of scale items (DeVellis, 2003). Next, multiple linear regression was used to determine whether the constructs of SCO, SCM, and collaboration have a significant impact on firm performance. The researcher's goal is to predict the behavior of the dependent variable of firm performance based on the analysis of the independent variables of SCO, SCM, and collaboration. Through the use of multiple linear regression, the researcher predicts that SCO, SCM, and collaboration will have a significant impact on firm performance.

## **IV. Results and Analysis**

CFA and multiple linear regression were the two techniques the researcher utilized to analyze the data and interpret results. Through the use of these tools, the researcher will reduce the number of scale items being analyzed into a set of four factors measuring the constructs of SCO, SCM, collaboration and firm performance. Once the scale items are organized into four factors, multiple linear regression is used to determine the relationship between SCO, SCM, collaboration and the effects of those constructs on firm performance.

### **Confirmatory Factor Analysis**

Confirmatory Factor Analysis (CFA) was the primary tool used for the reduction of individual survey items into a set of factors. Through CFA analysis utilizing the software program, SPSS, reliability, validity, and correlation analysis was conducted. A number of different methods such as Principal Components Analysis (PCA) with no rotation, Principal Axis Factoring (PAF) with both oblique and orthogonal rotation, and Maximum Likelihood Estimate (MLE) with both oblique and orthogonal rotation, were employed to confirm four factors existed and that the original model was valid. A careful review of original set of 67 variables revealed that there was a great deal of cross-loading and low factor scores. Consequently, confirmation of four factors was not possible due to the large number of items within the survey instrument.

Due to the results of the initial factor analysis, it was determined that a number of items within the survey instrument must be deleted due to cross-loading and low factor scores. After careful consideration, items that were redundant and items that did not

contribute to the overall goal of the research were removed through several iterations of factor analysis. The survey was reduced to 25 items for an original set of 67 items.

Once the scale was reduced, PAF with oblique rotation provided confirmation of four distinct factors. Oblique rotation was used as a rotation method within this factor analysis because it provides more meaningful results due to the assumption that all survey items within the scale must be uncorrelated. Due to the high correlation between SCO, SCM, and collaboration, oblique rotation was the most appropriate choice when conducting factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was measured at .747, as shown in Table 1. A figure of .80 indicates that proceeding with factor analysis is recommended. While the KMO for this project was lower than .80, it is close enough to merit moving forward with additional analysis. Additionally, Bartlett's Test of Sphericity indicates a significance of .000. Values of less than 0.05 indicate once again that factor analysis may be useful with this data.

**Table 1: KMO and Bartlett's Test of Sphericity Table**

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.747
Bartlett's Test of Sphericity	Approx. Chi-Square	874.900
	df	300
	Sig.	.000

The communalities in Table 2 provided by the factor analysis shows that extraction communalities are all relatively high indicating that the extracted factors represent the four constructs well.

**Table 2: Communalities Table**

Communalities		
	Initial	Extraction
Q8	.853	.576
Q9	.884	.579
Q17	.803	.559
Q18	.858	.685
Q20	.857	.818
Q33	.887	.580
Q38	.870	.793
Q39	.849	.756
Q40	.809	.665
Q42	.873	.730
Q43	.868	.750
Q47	.851	.496
Q59	.845	.640
Q60	.835	.656
Q62	.784	.520
Q68	.853	.579
Q69	.868	.672
Q71	.707	.549
Q73	.887	.698
Q74	.893	.721
Q75	.864	.590
Q77	.964	.899
Q78	.934	.876
Q79	.928	.871
Q80	.828	.430

Extraction Method: Principal Axis  
Factoring.

An analysis of the table depicting total variance explained in Table 3 demonstrates a possibility of five factors with Eigenvalues above 1, which suggests that there may be five distinct factors. However, the first four factors explain approximately



72 percent of the variance in the model. Therefore, in an effort to achieve data reduction, four factors were forced when conducting factor analysis.

**Table 3: Total Variance Explained**

Factor	Total Variance Explained						
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.087	40.347	40.347	9.764	39.055	39.055	8.026
2	3.852	15.409	55.755	3.536	14.145	53.200	3.476
3	2.164	8.657	64.412	1.922	7.688	60.889	5.024
4	1.804	7.215	71.627	1.465	5.859	66.748	7.278
5	1.309	5.235	76.862				
6	.911	3.644	80.506				
7	.760	3.041	83.547				
8	.633	2.531	86.078				
9	.531	2.124	88.203				
10	.490	1.960	90.163				
11	.427	1.708	91.870				
12	.390	1.560	93.430				
13	.293	1.173	94.603				
14	.257	1.026	95.629				
15	.237	.947	96.576				
16	.190	.758	97.335				
17	.164	.657	97.992				
18	.108	.432	98.423				
19	.092	.367	98.791				
20	.080	.319	99.110				
21	.063	.251	99.361				
22	.061	.246	99.607				
23	.046	.183	99.790				
24	.034	.137	99.926				
25	.018	.074	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

The rotated pattern matrix demonstrates the four distinct factors measuring SCO, SCM, collaboration, and firm performance. With the exception of Item 42, all items loaded on the appropriate factor for which the items were developed to measure. Item 42 cross loads on factors three and four; however, the factor score on factor three is considerably lower than corresponding factor score on factor four. As a result of this high factor score, item 42 was categorized in factor four.

**Table 4: Pattern Matrix**

<b>Pattern Matrix<sup>a</sup></b>				
	Factor			
	1	2	3	4
Q8		.619		
Q9		.622		
Q17		.772		
Q18		.802		
Q20		.919		
Q33				-.675
Q38				-.899
Q39				-.714
Q40				-.763
Q42			-.321	-.624
Q43				-.788
Q47				-.698
Q59	.731			
Q60	.824			
Q62	.606			
Q68	.793			
Q69	.807			
Q71	.709			
Q73	.777			
Q74	.749			
Q75	.573			
Q77			-.841	
Q78			-.866	
Q79			-.938	
Q80			-.521	

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 7 iterations.

## Reliability and Validity

Once four factors were confirmed, the internal consistency reliability was tested through analysis of Cronbach's Alpha. All values related to each of the constructs are much higher than the 0.7 value suggested in previous research (Nunnally, 1978). These results demonstrate a high level of reliability.

**Table 5: Descriptive Statistics**

Descriptive Statistics				
	Cronbach's $\alpha$	Mean	Std. Deviation	n
SCO	.88	5.97	.83	42
SCM	.92	4.49	1.44	42
Collaboration	.93	5.29	1.00	42
Firm Performance	.92	5.11	1.28	42

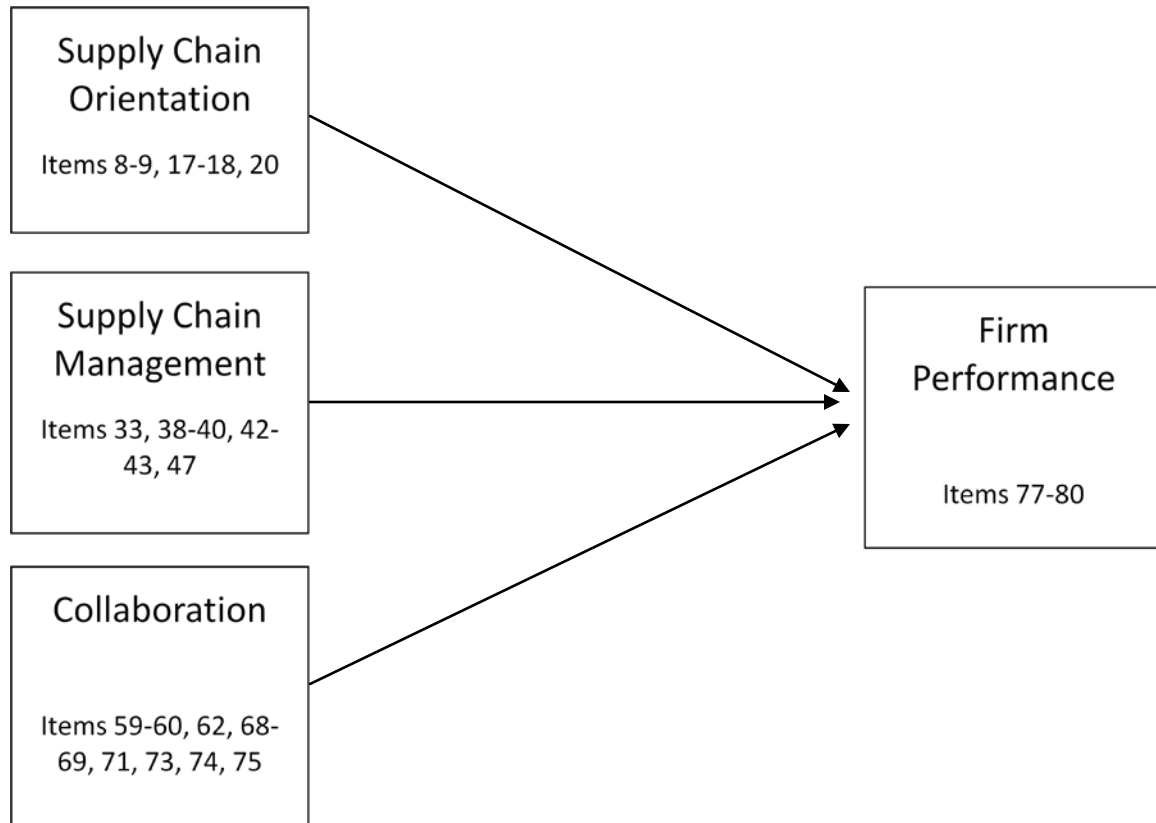
Validity was next assessed to determine that the scale is a suitable measure with the intent to measure the specific factor in question (DeVillis, 2003). Because the SCO, SCM, collaboration, and firm performance scales have been reviewed and utilized in past studies, content validity was confirmed. By using established measures, consistency with past research is established and scale development work needed to establish construct validity is not necessary.

## Multiple Linear Regression

Regression analysis was utilized to investigate the link between SCO, SCM, collaboration and firm performance. Regression is a statistical tool that is used to examine the relationship between independent variables and the effect of those variables on the dependent variable. In this research project, SCO, SCM, and collaboration are the independent variables as they are studied to determine the effect on firm performance,

designated as the dependent variable. Therefore, this research project attempts to validate how well SCO, SCM, and collaboration effect firm performance.

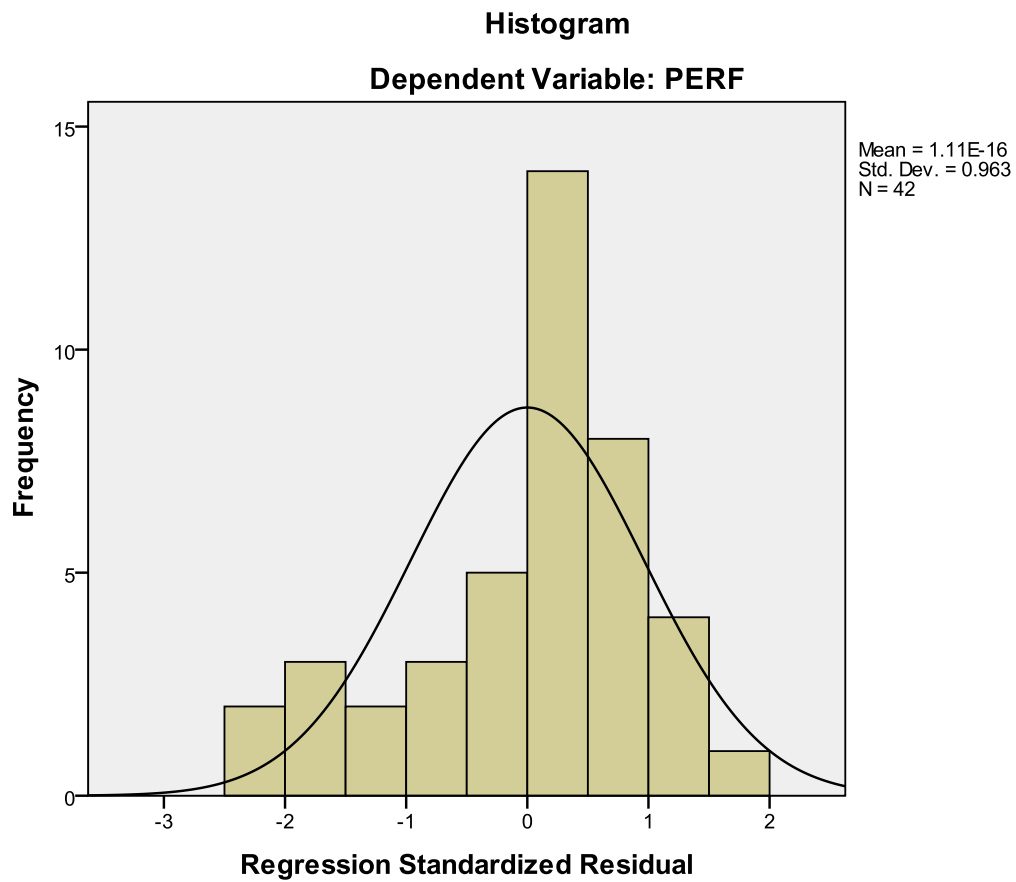
**Figure 3: Hypothesized Model**



### **Assessment of Normality**

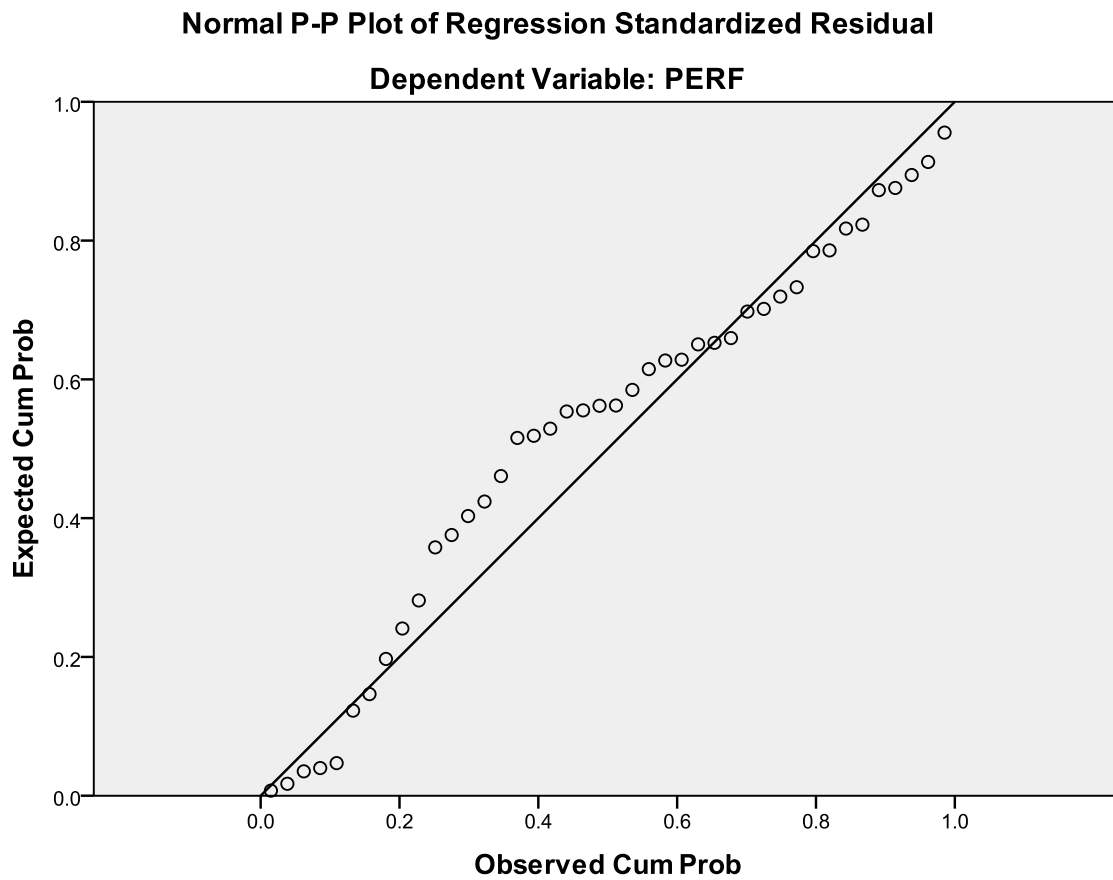
Upon first running the analysis, a histogram was reviewed to determine that the data follows the shape of a normal curve. As depicted in Figure 4, the histogram is acceptably close to the normal curve and there is an extremely small error term.

**Figure 4: Histogram**



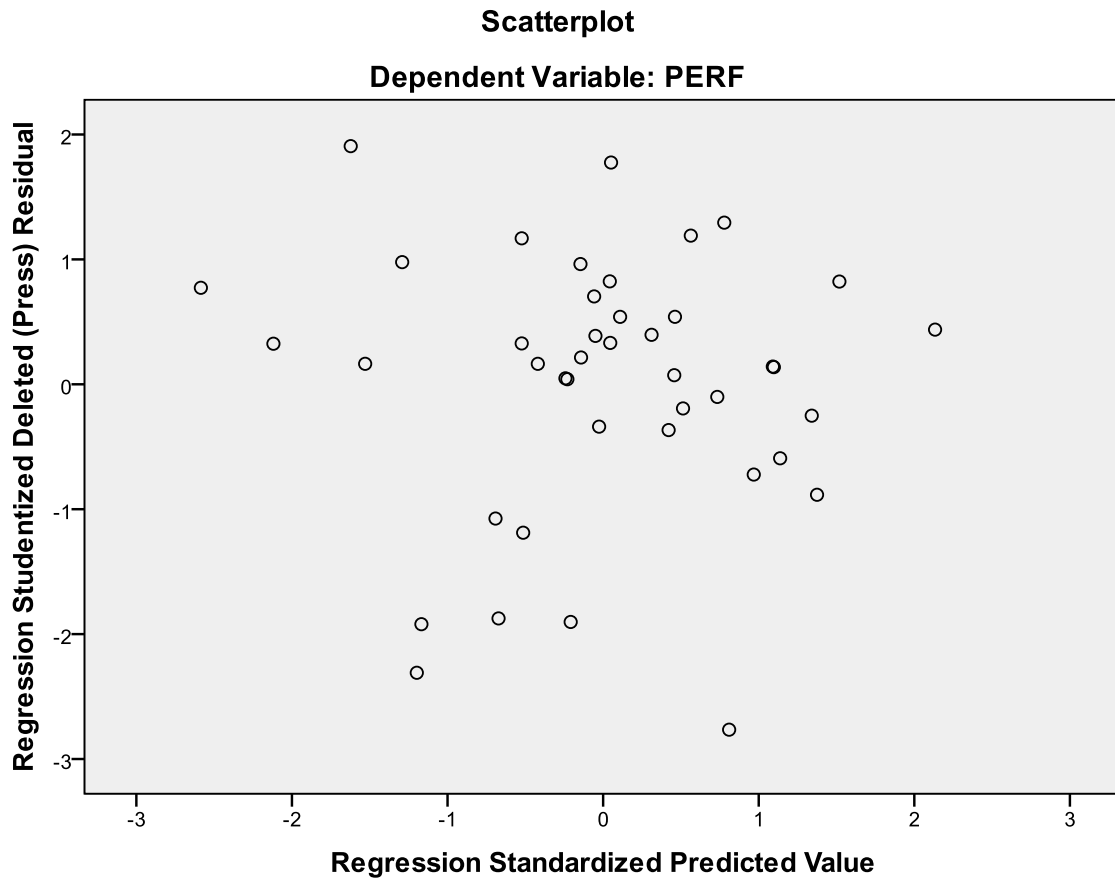
Additionally, a P-P Plot is another test of normality. As visualized in Figure 5, the P-P plotted residuals follow the 45-degree line, which indicates that the assumption of normality with this data is not violated.

**Figure 5: Normal P-P Plot of Regression Standardized Residual**



Lastly, a Scatterplot of the residuals shows that the variance of the errors increases with increasing predicted firm performance. Figure 6 demonstrates an acceptable amount of scatter with this data, indicating that the data is approximately normal.

**Figure 6: Scatterplot**



### **Linear Regression Results – Hypothesized Model**

Table 6 shows a summary of the results of linear regression that was performed on the original model. The Durbin-Watson statistic measures the presence of autocorrelation among constructs. Results of the Durbin-Watson statistics typically lie between 0-4. A general rule of thumb indicates that a result of 2 provides evidence that no autocorrelation exists. A review of the Durbin-Watson statistic (2.603) produced within this research project indicates that very little autocorrelation exists. This indicates

that for the most part, the error terms of the four factors are generally independent of one another which is an assumption that must be met when using linear regression as a tool.

Additionally, the  $R^2$ , as seen in the model summary is .29 which indicates that 29 percent of the variance of firm performance is explained by this model. This result is not surprising. There are a large number of items that contribute to the performance of a firm beyond SCO, SCM, and collaboration. These constructs represent a small set of possible predictors, however, these three constructs do account for a little over a quarter of the variance of firm performance.

**Table 6: Model Summary – SCO, SCM, and Collaboration**

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.541 <sup>a</sup>	.293	.237	1.08904	.293	5.249	3	38	.004	2.603

a. Predictors: (Constant), COLL, SCO, SCM

b. Dependent Variable: PERF

The model summary displayed in Table 6 shows a significance level of  $P < .005$ , which indicates that the model is significant. However, a review of the significance of the standardized Beta coefficients in Table 7 indicates that only SCO has a significant relationship with firm performance when each factor is reviewed individually.

Collaboration is just outside the significance level of  $P < .05$  and SCM is not significant.

The standardized Beta coefficient provides a measure describing which of the independent variables have a greater effect on the dependent variable. The results



associated with this research project indicate that SCO and collaboration have a greater effect on firm performance than SCM.

**Table 7: Coefficients – SCO, SCM, and Collaboration**

Coefficients <sup>a</sup>							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-.145	1.488		-.097	.923		
1 SCO	.429	.207	.286	2.072	.045	.977	1.023
SCM	.120	.157	.138	.760	.452	.567	1.764
COLL	.408	.225	.326	1.812	.078	.576	1.737

a. Dependent Variable: PERF

#### *Multicollinearity Assessment – Hypothesized Model*

A review of the diagnostic measures of multicollinearity indicates that multicollinearity could be an issue in the hypothesized model. There are various methods for confirming multicollinearity. First, a review of the Coefficients in Table 7 shows that the tolerance for SCO is rather high. However, the tolerances for SCM and collaboration are lower and closer to 0. In order for multicollinearity to be present within the model, these tolerances must be close to 0. It would appear from this assessment that there may be an issue with multicollinearity between SCM and collaboration. Next, the variance inflation factors (VIF) were reviewed. Also as displayed in Table 7, the VIF associated with SCO is low, however, the VIF's for SCM and collaboration are closer to the value of 2. Variance inflation factors above 2 indicate a problem with multicollinearity.

**Table 8: Collinearity Diagnostics – SCO, SCM, and Collaboration**

Collinearity Diagnostics <sup>a</sup>							
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	SCO	SCM	COLL
1	1	3.914	1.000	.00	.00	.00	.00
	2	.061	7.997	.03	.06	.52	.00
	3	.017	15.064	.00	.27	.38	.68
	4	.008	22.591	.96	.67	.10	.31

a. Dependent Variable: PERF

Additionally, the Collinearity Diagnostics table in Table 8 was reviewed. In order for multicollinearity to be deemed non-problematic, the Eigenvalues must be much larger than 0. As displayed in Table 8, the Eigenvalues of SCM and collaboration are quite close to 0, indicating multicollinearity could be a problem between these two factors. Conversely, the Eigenvalue for SCO is much higher than those associated with SCM and collaboration.

Lastly, when reviewing the condition indices listed in Table 8, the condition index for factor four is approaching the value of 30, which does indicate an issue with multicollinearity.

The combination of these measures indicates that multicollinearity could be an issue within the hypothesized model. This is not a surprising discovery as the constructs of SCM and collaboration are highly correlated. The construct of SCM measures how

supply chain partners integrate their practices so that they may jointly work together towards a common goal. The construct of collaboration is very similar to that of SCM. The one difference between these constructs that can be detected is the inclusion of survey items measuring the internal integration of a firm within the collaboration construct. External integration as measured in the collaboration construct evaluates the amount of information sharing that occurs between partners as well as the sharing of risks and rewards between those partners. Additionally, the collaboration construct also measures the amount of cooperation between supply chain members, the building of relationships between these members, as well as the connectivity of business processes between supply chain members. Many of these concepts are explored in SCM construct as well. Essentially, the external integration portion of the collaboration construct could also measure SCM within a firm.

### **Linear Regression Results – Revised Model**

The results provided in the multicollinearity diagnostic measures indicate that multicollinearity could be an issue within the hypothesized model. Therefore it was necessary to eliminate the SCM construct because it is so highly correlated to the collaboration construct as well as the lack of significance of the construct in the hypothesized model. Once SCM was eliminated, a histogram, P-P Plot and Scatterplot were assessed and the normality of the data was once again confirmed. In a review of the model summary, as shown in Table 9, after SCM was eliminated, the  $R^2$  decreased slightly to .28 indicating that SCO and collaboration explain 28 percent of the variance of firm performance. Removing SCM as a construct only reduced the  $R^2$  by one percentage

point which indicates that SCM is not a crucial construct within the model. Additionally, as in the hypothesized model, the new model is also significant at  $P < .005$ , as shown in Table 9.

**Table 9: Model Summary – SCO and Collaboration**

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.531 <sup>a</sup>	.282	.245	1.08313	.282	7.667	2	39	.002	2.609

a. Predictors: (Constant), COLL, SCO

b. Dependent Variable: PERF

The coefficients were next reviewed as displayed in Table 10. These results reveal that both SCO and collaboration are significant at  $P < .05$ , which indicates that there is a relationship between SCO, collaboration, and firm performance.

**Table 10: Coefficients – SCO and Collaboration**

Coefficients <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.313	1.463		-.214	.832		
	SCO	.449	.204	.299	2.196	.034	.993	1.007
	COLL	.519	.171	.414	3.043	.004	.993	1.007

a. Dependent Variable: PERF

#### *Multicollinearity Assessment – Revised Model*

Upon review of the results of the linear regression run on the revised model, it does not appear that multicollinearity is a major issue. First, a review of the Coefficients

table shows that the tolerances for both SCO and collaboration are rather high. In order for multicollinearity to be present within the model, these tolerances must be close to 0. The lowest tolerance is .99, which is substantially higher than 0. Next, the variance inflation factors were reviewed. As shown in Table 10, all results are less than 2. Variance inflation factors above 2 would indicate a problem with multicollinearity. Additionally, the Collinearity Diagnostics table in Table 11 was reviewed. This is the only diagnostic measure that indicates multicollinearity could be a problem. In order for multicollinearity to be deemed non-problematic, the Eigenvalues must be much larger than 0. As witnessed in Table 11, the Eigenvalues of SCO and collaboration are quite close to 0, indicating multicollinearity could be a problem.

**Table 11: Collinearity Diagnostics – SCO and Collaboration**

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	SCO	COLL
1	1	2.967	1.000	.00	.00	.00
	2	.025	10.883	.02	.24	.83
	3	.008	18.933	.97	.76	.17

a. Dependent Variable: PERF

The fourth diagnostic measure assessed was a review of Correlation in Table 10. If correlations for any of the items are over .8, then multicollinearity might be an issue.

As determined from the table below, none of the correlation values are above .8, therefore once again, multicollinearity does not appear to be an issue.

**Table 12: Pearson Correlation**

		Correlations		
		PERF	SCO	COLL
Pearson Correlation	PERF	1.000	.334	.440
	SCO	.334	1.000	.086
	COLL	.440	.086	1.000
Sig. (1-tailed)	PERF	.	.015	.002
	SCO	.015	.	.295
	COLL	.002	.295	.
N	PERF	42	42	42
	SCO	42	42	42
	COLL	42	42	42

Lastly, when reviewing the condition indices listed in Table 11, there are no values greater than 30, which would indicate the presence of multicollinearity. Therefore, these results suggest that there is no serious problem with multicollinearity in this model.

### **Hypothesis Testing**

In reviewing Tables 6 and 7, it can be determined that the hypothesis is partially supported. Table 6 indicates that SCO is significant at .045 ( $P < .05$ ) and therefore is positively related to perceived firm performance. However, in this model, both SCM and collaboration are not significant. Once SCM is removed from the model, both SCO

(.034) and collaboration (.004) are significant ( $P < .05$ ). Therefore, both SCO and collaboration are positively related to firm performance.

## **VI. Discussion**

The final chapter of this research study presents conclusions, limitations to the findings as well as future research possibilities based on the results of this research effort. After an extensive literature review on SCO, SCM, and collaboration, it can be determined that SCO is a conglomerate of the cultural attributes that are inherent within an organization; SCM is the compilation of the processes that supply chain partners perform together to enhance the performance of the supply chain; and collaboration is the extent to which cooperation between internal departments and external supply chain partners occurs. This research project evaluated whether SCO, SCM, and collaboration have an effect on firm performance. A survey instrument based upon scales developed and tested in previous studies was sent to executive-level individuals throughout the industry. The results of this study partially support the hypothesis in that SCO and collaboration are significant and can be linked to firm performance. The hypothesis was not supported in that SCM as a construct was not significant and could not be linked to firm performance.

### *Relevant Findings*

The primary findings within this research project indicate that SCO and collaboration are linked to firm performance. SCM was not linked to firm performance. However, upon careful examination, many of the SCM and collaboration scale items were quite similar. While many of the items were deleted as factor analysis was performed, the constructs of SCM and collaboration were predisposed to measure nearly identical practices. Because the SCM and collaboration constructs were so highly



correlated, it can be understood why collaboration as a construct became significant as SCM was eliminated from the model.

### *Limitations*

There were a number of limitations that appeared as the research project was conducted and concluded. First, the database utilized to acquire the contact information of executive-level individuals was obtained through the Intermodal Association of North America (IANA). This membership directory is heavily skewed towards individuals that work in the transportation field. Therefore, it is a distinct possibility that there were only a small number of individuals who fit within the desired sample qualifications developed by the researcher. Because this database was limited to the transportation industry, it is possible that many large manufacturing, service, retail or warehousing firms were excluded from this research project because they are not members of IANA.

Yet another limitation associated with this project is the small sample size. Because the membership directory for IANA includes approximately 1,000 individuals as members, the response rate was a function of the number of members contacted. A more suitable potential respondent database would have included the CSCMP membership directory. However, this database has been over-utilized in the previous months and it was feared that the response rate would suffer using this database due to the large number of requests for survey data generated by AFIT that has recently been directed at this group of professionals. Because of the small sample size, performing factor analysis on the original survey instrument using rotation was impossible. The original survey instrument contained approximately 80 items and returned only approximately 40 responses. When the survey instrument was reduced to approximately 25 items, factor

analysis with rotation was achievable. Had there been a greater number of responses, it is possible that the scales developed for each construct could have been used without eliminating items and the original model could have been studied.

Additionally, all data generated by the survey were a result of self-reported measures. Respondents were asked to truthfully provide information on their culture, supply chain management processes, collaborative practices, and the performance of their firm. Those responses submitted by the respondents may not have been accurate when considering that the data is self-reported. Individuals may skew their responses based on a perception of how they believe they operate versus how they actually operate. Also, there is a possibility that responses submitted were falsely reported in an effort to disguise actual processes, practices and performance. Potential respondents were briefed on the anonymity and confidentiality of the collected data, however, they may have purposely tried to skew their results in an attempt to hide actual processes, practices and performance.

#### *Future Research*

It is believed that the model presented within this research project was generally supported by the results of the analysis. SCO and collaboration are linked to firm performance. Due to the high correlation between SCM and collaboration, SCM results were not significant and collaboration was significant in terms of firm performance. Due to the small sample size used within this research project, it would be beneficial to attempt this same study with a larger sample population size containing individuals within the supply chain industry from not only firms within the transportation industry, but also manufacturers, retailers, and distributors. In the future, researchers could partner

with supply chain associations to obtain larger databases and boost response rates. A larger sample size may allow for an analysis to be performed on the survey instrument without having to eliminate survey items.

Due to the large number of survey items in the original survey instrument, it was not possible to include additional constructs of interest. The additional constructs might include technology usage and the maturity. Previous literature proposes that firms who utilize enabling technologies to integrate cross-functional departments internally and supply chain partners externally may lead to better firm performance (Sanders and Premus, 2007). Also, in the future researchers may also want to supplement the firm performance construct with a supply chain performance construct, measuring inventory availability, new product and service offerings and introductions, product quality improvements, and speed of delivery. Researchers might want to determine the effects of SCO, SCM, and collaboration on supply chain performance in addition to firm performance.

In addition, a scale should be developed measuring competitive advantage in an effort to determine if SCO, SCM and most importantly, collaboration does in fact create a competitive advantage within an organization. Many studies measure competitive advantage through the use of survey items that ask respondents to rate their financial and marketing performance relative to that of their competitors. The data collected from these questions is very subjective as it is possible that respondents do not know for certainty the performance of their competitors. It would be valuable to create a new construct measuring competitive advantage with more concrete measures.

## *Conclusion*

The results of this research project indicate that SCO and collaboration are linked to firm performance. These results provide direction for future focus for organizations who wish to improve the overall performance of their firm. While SCO is more of a cultural component to an organization, firms wishing to improve on their financial and marketing performance should first concentrate on building trust and commitment within their own organization as well as across supply chain partner organizations and build foundations that will allow for strong and solid relationships with future supply chain partners as well as cultivating a team of executives who promote collaborative practices both internally and externally. Once this cultural component has been addressed, it would be advisable to firms to begin addressing the concept of collaboration in their organization. Firms who build cross-functional teams within their organization and who establish practices that support mutually shared goals within the supply chain may use these practices to build clusters of knowledge that will allow them a competitive advantage among their competitors.

## Appendix A: Description of Scale Items

Constructs and Measurement Items	Mean	Std. Dev.
<b><i>Supply Chain Orientation (Cronbach's Alpha = .875)</i></b>		
1. Promises made to our supply chain members by our business unit are reliable.	6.19	0.917
2. Our business unit is knowledgeable regarding our products and/or services when we are doing business with our supply chain members.	6.17	1.057
3. We are patient with our supply chain members when they make mistakes that cause us trouble but are not repeated.	5.48	1.131
4. Our business unit is willing to make cooperative changes with our supply chain partners.	5.83	0.908
5. We view our supply chain as a value added piece of our business.	6.17	1.057
<b><i>Supply Chain Management (Cronbach's Alpha = .921)</i></b>		
1. Our supply chain members frequently (at least once per month) exchange demand information with each other to facilitate operational plans and reduce reliance on second-guesses.	4.14	1.983
2. Our supply chain members share the results of performance measures with each other to improve the efficiency and effectiveness of the supply chain processes.	4.38	1.950
3. Our supply chain members improve the quality of products and services to the end users in a collaborative manner.	4.86	1.523
4. Our supply chain members actively propose and implement cost reduction ideas.	4.79	1.554
5. Our supply chain members jointly manage logistics and inventory in the supply chain.	4.69	1.774
6. Our supply chain members substantially reduced channel complexity over the past three years to closely work with a selected set of supply chain members.	4.52	1.642
7. In certain situations in our supply chain, one firm sets the standards for all supply chain members to follow.	4.05	1.738
<b><i>Collaboration (Cronbach's Alpha = .930)</i></b>		
1. Our firm develops a common goal to align the efforts of all processes, in addition to setting specific objectives for each process.	5.79	1.200
2. Our firm ensures compatibility among all relevant internal processes.	5.43	1.252
3. Our firm communicates information in a timely manner about specific internal processes to facilitate other related processes.	5.60	1.014
4. Our firm, along with our major partners, tries to develop common goals to	5.43	1.434

align process efforts.		
5. Our firm, along with our major partners, ensures compatibility between related processes of different firms.	4.90	1.358
6. Our firm, along with our major partners, share information in a timely manner to facilitate cross-organizational processes.	5.40	1.127
7. Our firm, along with our major partners, work together to reduce operational complexity.	5.21	1.240
8. Our firm, along with our major partners, focus on reducing channel complexity.	5.02	1.220
9. Our firm, along with our major partners, regularly evaluate whether there are redundant activities within various processes across firms.	4.86	1.280
<hr/>		
<b><i>Firm Performance (Cronbach's Alpha = .918)</i></b>		
1. Our business unit's return on assets (ROA) met or exceeded financial goals for ROA set by our firm.	5.03	1.459
2. Our business unit's return on investment (ROI) met or exceeded financial goals for ROI set by our firm.	5.18	1.466
3. Our business unit's return on sales (ROS) met or exceeded financial goals for ROS set by our firm.	5.13	1.362
4. Our business unit's sales growth met or exceeded financial goals for sales growth set by our firm.	5.13	1.418
<hr/>		

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## **Vita**

Ms. Jodi M. Tinney graduated from Vandalia-Butler High School in Vandalia, Ohio. She entered undergraduate studies at Ohio University in Athens, Ohio where she graduated with a Bachelor of Science degree in Journalism in June of 1999. Upon graduation she received her first job role at U.S. Bank in Cincinnati, Ohio. Throughout her time with U.S. Bank, she worked to obtain a Master of Business Administration degree at Xavier University in Cincinnati, Ohio.

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<b>REPORT DOCUMENTATION PAGE</b>				Form Approved OMB No. 074-0188	
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to an penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p><b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b></p>					
<b>1. REPORT DATE (DD-MM-YYYY)</b> 14-06-2012		<b>2. REPORT TYPE</b> Master's Graduate Research Project		<b>3. DATES COVERED (From – To)</b> Jan 2010 - Jun 2012	
<b>4. TITLE AND SUBTITLE</b> The Effects of Supply Chain Orientation, Supply Chain Management, and Collaboration on Perceived Firm Performance.				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b> Tinney, Jodi M.				<b>5d. PROJECT NUMBER</b>	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)</b> Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 Hobson Street, Building 642 WPAFB OH 45433-7765				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>  AFIT/ILS/ENS/12-06	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>  Intentionally left blank				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT:</b> DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.					
<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b> <p>The purpose of this research is to examine the relationship between supply chain orientation, supply chain management, collaboration and the effects on firm performance. These concepts are of great interest to numerous organizations who have adopted a supply chain management paradigm in managing their operations. As established in previous research however there is a distinction between supply chain orientation and supply chain management. Supply chain orientation is the manifestation of the supply chain mindset within the firm, while supply chain management is the propagation of the supply chain mindset across firms. As has been established in the literature numerous times, there is a presumed link between supply chain orientation and/or supply chain management, and organizational performance. One presumed link between supply chain orientation, supply chain management, and firm performance is collaboration. The knowledge-based view holds that firm-specific knowledge “bundles” help firms create difficult to replicate capabilities, thereby creating a competitive advantage in the marketplace. One commonly held view is that collaboration helps create these firm-specific knowledge bundles. This research project looks at the constructs of supply chain orientation, supply chain management, and collaboration on perceived firm performance. The researcher offers significant statistical results on the investigation of the relationships between these constructs.</p>					
<b>15. SUBJECT TERMS</b> <p>Supply Chain Orientation, Supply Chain Management, Collaboration, Organizational Performance</p>					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>  UU	<b>18. NUMBER OF PAGES</b>  59	<b>19a. NAME OF RESPONSIBLE PERSON</b> Dr. William A. Cunningham (ENS)
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			<b>19b. TELEPHONE NUMBER (Include area code)</b> (937) 255-6565, ext 4283; e-mail: William.cunningham@afit.edu